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ALBUM FOR 1906

Ambursen Hydraulic Construction Company

176 Federal Street, Boston, Massachusetts

THE KIND OF DAM WE DON'T BUILD

There is still a lingering idea in the minds of a few that because a dam is "solid" it is necessarily stronger than one which is "not solid." The precise contrary is the case and in the ratio of about 2½ to 1. The above cut is an illustration of what it is safe enough to say will never happen to a concrete-steel dam. We have other photographs in our office but select only one here to correct an otherwise hasty impression. A large number of solid dams have failed and many more will fail until people come to understand the inherently defective design, which, however, was the only design possible under the then state of the art.

SCHUYLERVILLE DAM

This dam, undoubtedly the starting point of revolutionary methods in hydraulic construction, may appropriately stand at the beginning of this album. It was begun September 27, 1904, finished December 31 and closed on March 11, 1905. Rollway 25 to 28 ft. high and 250 ft. long. Time required for building (exclusive of coffer dam) 96 days. Time required for closing, forty-five minutes.

The dam is on the Battenkill near Schuylerville, N. Y., the owners being the American Wood Board Co., George F. Hardy, 309 Broadway, N.Y., Consulting Engineer.

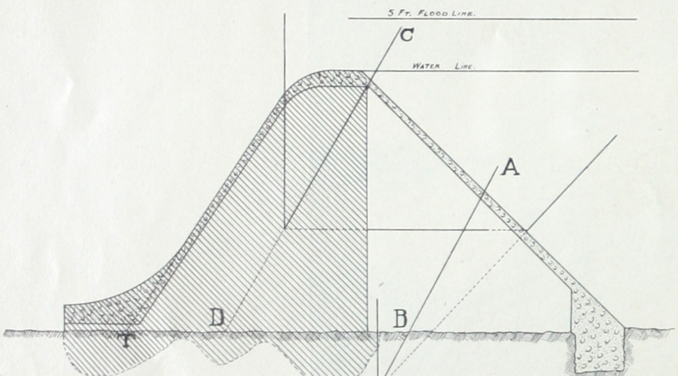


PLATE 1

PLATE 1 shows the cross section of the solid dam as originally designed for this site superimposed on the cross section of the reinforced dam as finally adopted. Note the difference in the excavation required for foundations. Note the width of the supporting base. Note the position of the flood resultants on both the solid dam and the concrete-steel dam in connection with the distribution of corresponding base pressures; and form your own ideas of their relative stability.

PLATE 2 shows the working cross section typical of an apron dam on rock foundations. Note the accessibility of the interior for inspection. Note that the height of the tail water equalizes inside the dam through the drains. Note that any chance leakages through seams in the rock can exert no upward pressure on the dam as there is no base on which to press. Note the vent openings at the top of the apron to break the partial vacuum and prevent "trembling" of the dam. Particularly note the thoroughly practical and electric lighted bridgeway through the dam 16 feet above the river bed.

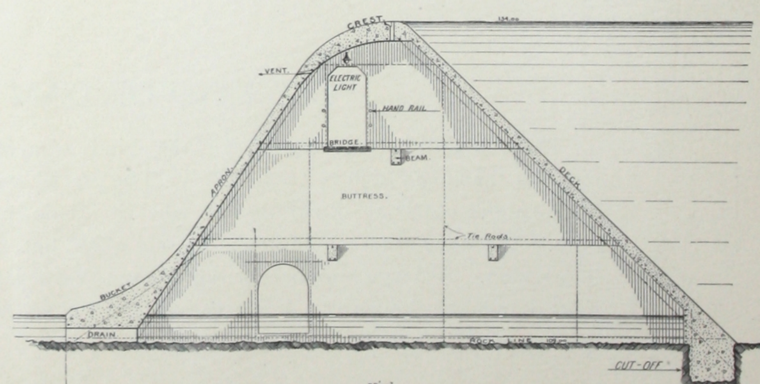


PLATE 2

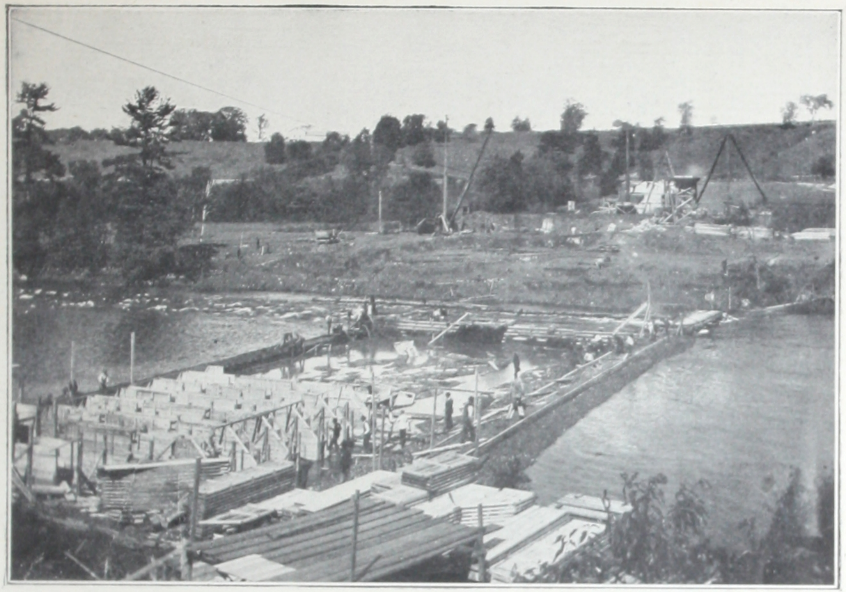


PLATE 3

PLATE 3. This photograph was taken on September 30, three days after commencing to set up the temporary forms. The foundation is on Hudson River shale. A trench 5 feet wide and 3 feet deep receives the cut-off wall at the heel of the dam. No excavation was made for the buttresses, the only preparation being to wash the silt and slime out of the crevices of the rock by a water jet.

PLATE 4. In this view looking up stream the dam is shown as completed except for the temporary openings through the apron, through which the river is discharged before closing. These openings are subsequently closed and the apron made continuous.

PLATE 4

PLATE 5 was taken about March 26, with a flood of 4 feet 6 inches on the rollway. The night before this photograph was taken immense fields of gorged ice up to 44 inches thick went out. At times the ice would strand on the crest and pile up to a height of several feet until the force of the water carried it over.

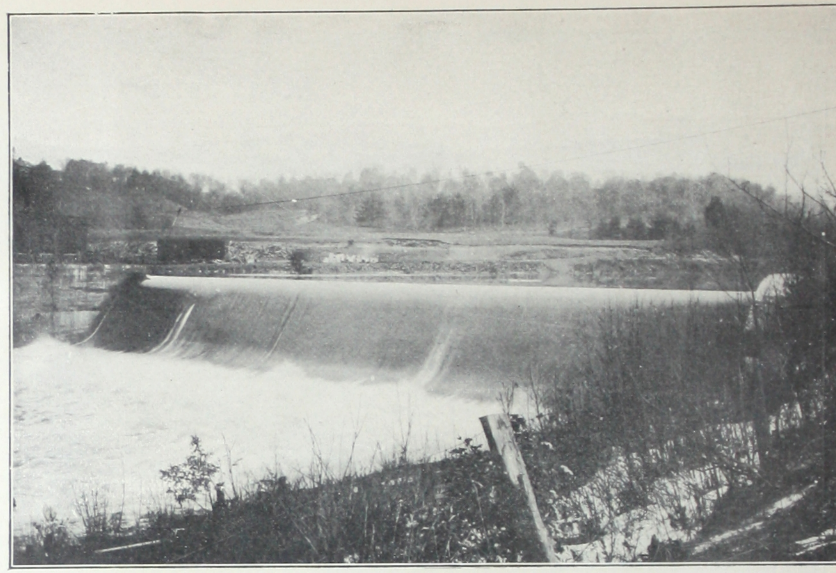


PLATE 5.

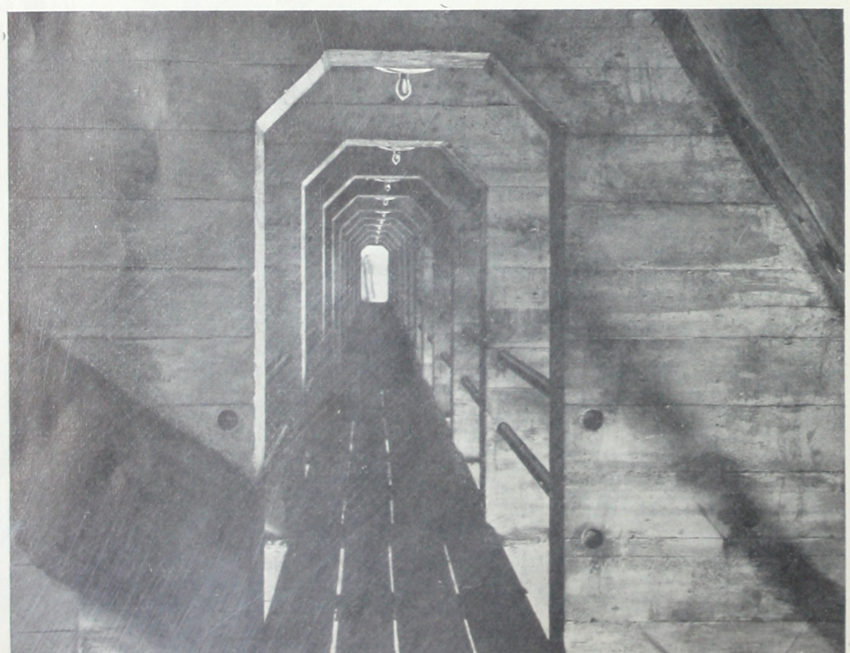


PLATE 6.

PLATE 6 is a view through the interior bridgeway which forms the only means of communication between the mill and the railway station on the opposite bank. The bridgeway is well lighted and ventilated by the air drawn through the vents in the apron. It is in daily use by all the operators, officers and visitors. At the time the photograph was taken there were probably several people passing through the dam with 4 feet of water rolling over their heads, all of which may be appreciated by referring back to Plate 5.

The absolute silence on the interior of the dam contrasted with the roar of the water outside was as remarkable as unexpected. This bridge is not a "freak" but a thoroughly practical application of the properties of the dam and has been substantially repeated by us in nearly every subsequent structure.

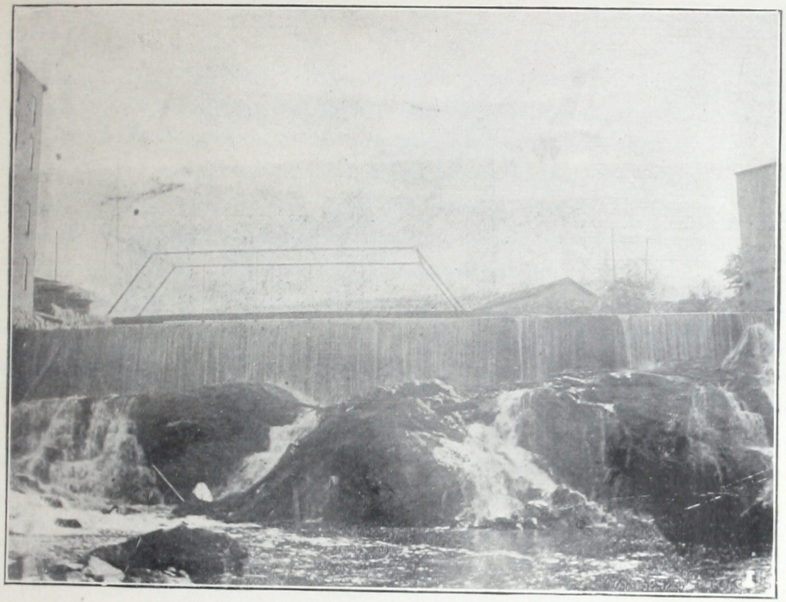


PLATE 7.

THERESA DAM

This illustrates the first concrete-steel dam ever built. It was designed by the predecessors of this Company, Messrs. Ambursen & Sayles, formerly of Watertown, N. Y., and was built in 1903 for a flour mill on the Indian River.

Length 125 feet. Maximum height 15 feet.

PLATE 8 shows the same dam laden with ice in the severe winter of 1903. During the spring of the following year ice 36 inches thick went over the dam. This photograph with others of a like character in this album effectually answers the question as to the behavior of reinforced concrete in the winter season.

The above dam is in the extreme northern portion of New York state where the winters are of Canadian severity.

PLATE 8.

METHOD OF CLOSING DAM

PLATE 9. The ordinary method of closing a dam is to build a high coffer dam around the gap, reaching above the pond level. Behind this coffer dam the closure is effected while the water rises outside. In many cases such a coffer dam will cost several thousand dollars and a month's time to build, with all the attendant risks.

Note the simplicity of the method possible with a Concrete-Steel dam. The minimum flow of the river is computed,—also the rate of rise after closing. Enough openings are left to take care of the low water flow when running about one-quarter full. The deck and buttresses are extended to form a horizontal shelf, through which openings are left registering with vertical grooves in the buttresses below. Stop logs are prepared for temporary closing, also two loose-fitting forms in each bay. A grid of reinforcing rods, wired together at proper intervals, is also prepared. All this work is done while the main coffer dam is in place and the material is laid on the shelf until required. The flow is then diverted through the prepared openings and the remainder of the dam completed.

When ready to close, any day may be selected when the water is at the most favorable stage. A crew of four to six men is required at each opening. The stop logs are rapidly dropped in place, the forms are lowered through the openings in the top and set out against their respective stops. Drain pipes, previously prepared, are inserted through the bottom of the forms. The grid of reinforcing steel is lowered in position, bearing against the concrete shoulders in the buttresses. The space between the forms is then rapidly filled with concrete, requiring about 1½ yards in each opening, and the hatch spiked on.

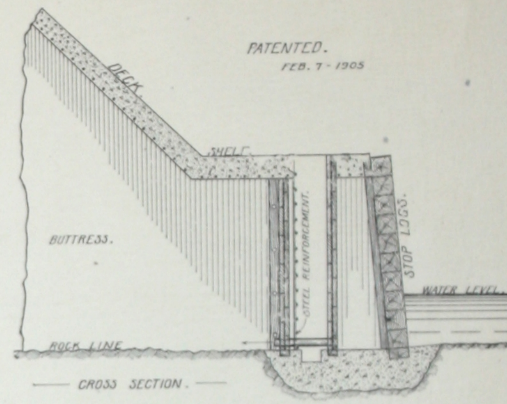
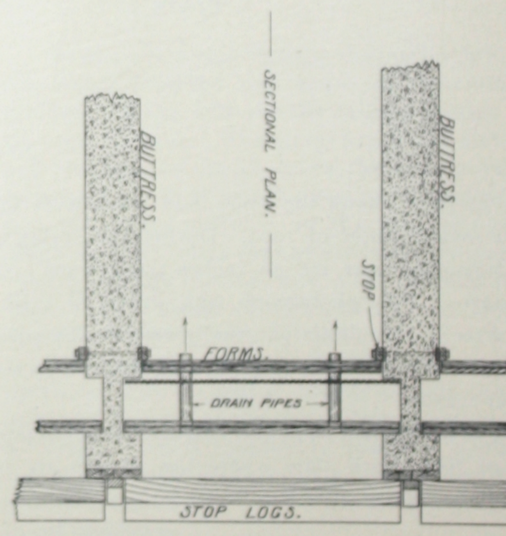


PLATE 9



In the actual closing of the Schuylerville dam for instance the full operation required just 45 minutes, the crew on one opening making a record of 7 minutes from dropping the stop logs to nailing on the hatch. The particular point to note is that the drain pipes carry away any leakage passing the stop logs, so that no pressure is allowed to accumulate in the space between the stop logs and the form. The concrete block can therefore set without danger of washing out. In a month or so when fully hardened, the drain pipes are finally stopped with two soft pine plugs, enclosing a plug of concrete, and the dam is permanently closed.

This form with some modifications is now our standard method of closing dams. Not only that, but we find it cheaper and a guarantee of safety to leave *every* bay open across the whole width of the river. The cost of the dam itself is very slightly increased but this increase is more than off-set by the saving in the cost of the coffer dam. We build a light and temporary coffer dam and immediately set the footing courses of the dam up to uniform grade across the whole river, letting the water run between the piers thus established. From that moment we are done with the coffer dam which may be carried out or removed without detriment to the work.

We have thus created an artificial footing for ourselves upon which we proceed to construct the remainder of the dam while the river is flowing through under our feet. Any ordinary rise will still be carried off through these openings, and even a flood of magnitude would do no more harm than to drive us off the work for the time being.

When the dam is ready to be closed these openings are closed one after the other without any haste, and usually at intervals of two or three days so as to permit of the stop logs being used over and over again. When the river is finally narrowed down to as few openings as is considered wise, the remaining openings are closed simultaneously and the dam is complete.

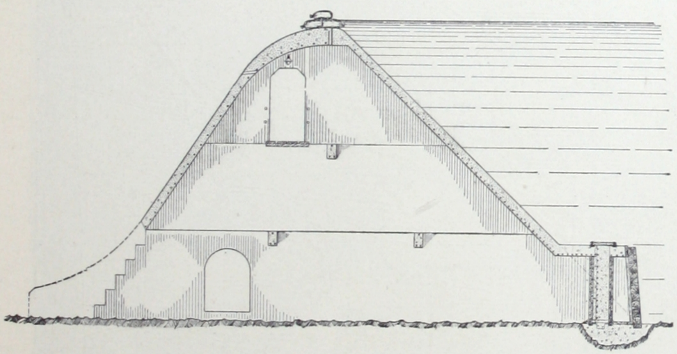


PLATE 10

In the case of a full apron dam corresponding openings have of course been left in the apron. To close these, flashboards are set on the crest above the openings and for a distance each side and are made tight by sand bags, or sand bags alone may be used if the water is low. Under the protection of these flashboards the lower openings are closed and when sufficiently hardened the flashboards are removed.

We may be pardoned for believing that this method of constructing and closing dams, minimizing the cost of the cofferdam, saving the valuable time in the best part of the season otherwise required to build the cofferdam, and almost nullifying the danger of floods, is a distinct engineering feature in hydraulic construction.

JUNIATA DAM

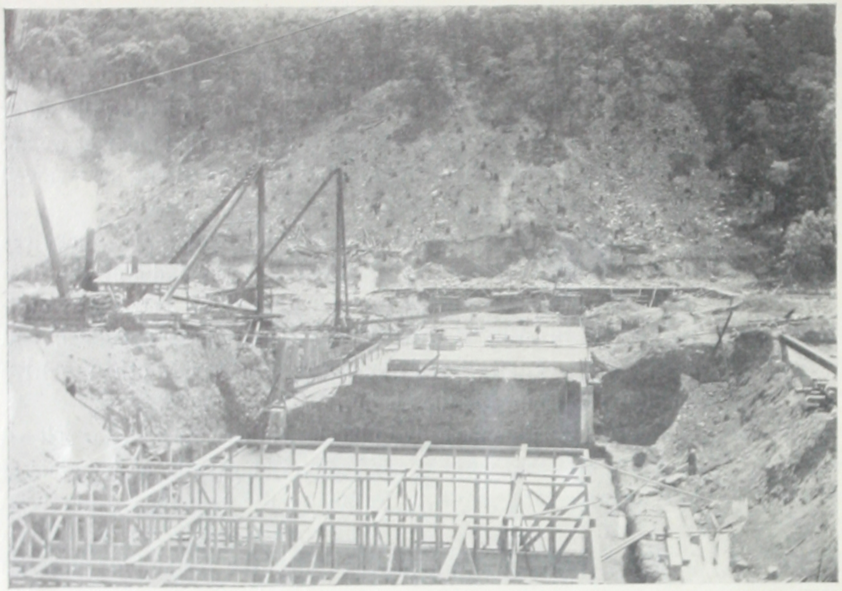


PLATE 11.

This is a series of six photographs taken during the construction of the dam for the Juniata Hydro-Electric Co. on the Juniata River above Huntingdon, Pa. It is essentially the same dam as the Schuylerville Dam except as modified for soft foundations. The rollway of this dam is 375 feet long and 28 feet high. The total length of the dam including the power house and earth embankment is roughly 1200 feet.

PLATE 11 is an admirable photograph showing the nature of the foundations which are strictly gravel there being no ledge in sight. A stratum of hard-pan underlies this gravel at a depth of 18 feet. In the foreground is the excavation and flooring of the wheel pit and beyond it is seen the gravel supporting the dam and through which are trenched the two cut-off walls which go down until they intersect the hard-pan.

PLATE 12 is a view from the other end of the dam and shows the floor about completed, ready for the reception of the buttresses. The floor is stepped up at different points to accommodate the slope of the ground and save material, while the discharge lip of the apron is kept level, notwithstanding.

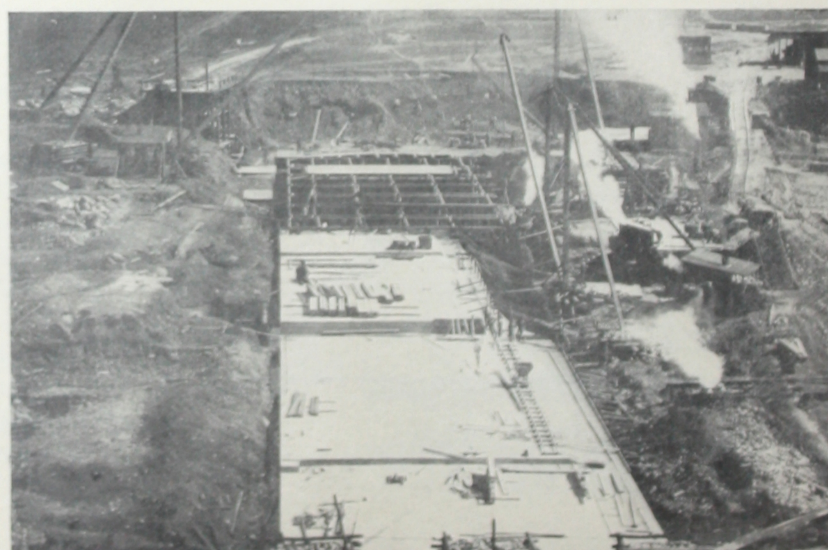


PLATE 12.

PLATE 13 shows the reinforcing rods and lower deck forms in place.

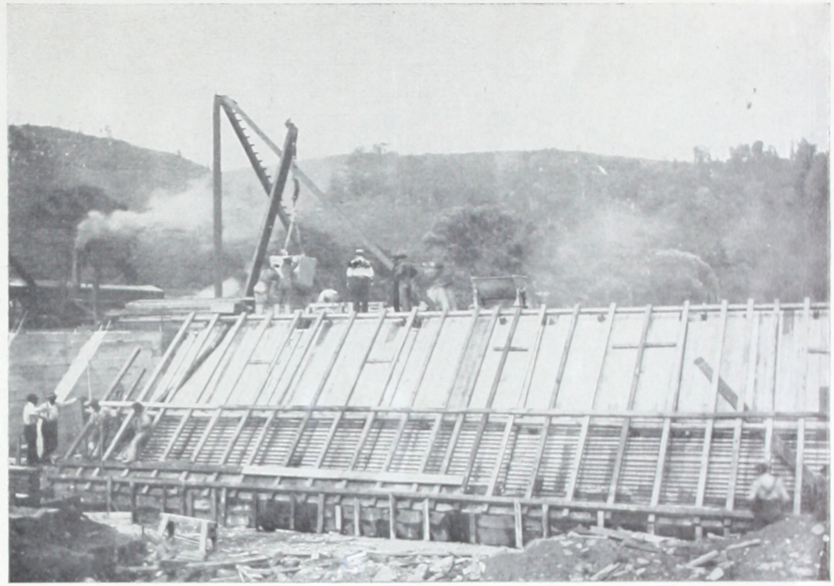


PLATE 13.

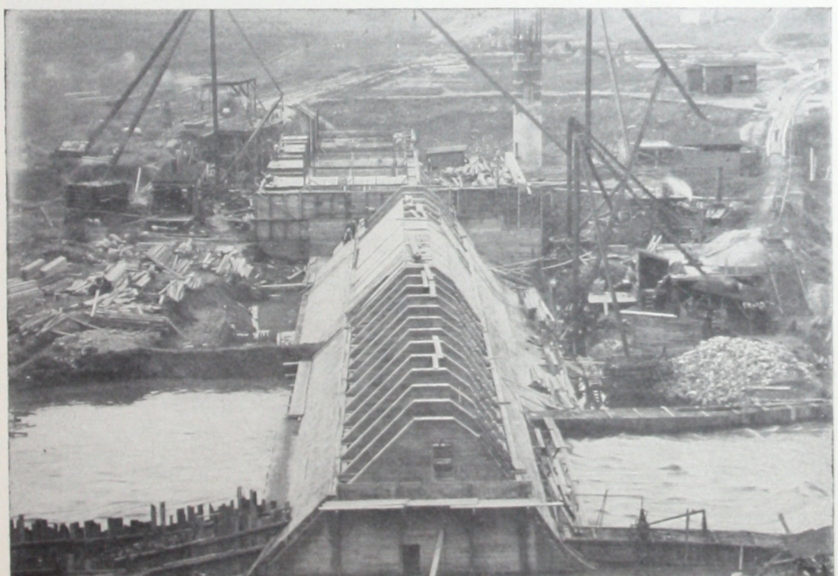


PLATE 14.

PLATE 14 is a bird's-eye view showing one-half of the rollway in an advanced stage of completion. The water is passing through the sluice openings without interrupting the work overhead. The buttresses are plainly shown and parts of the deck in place.

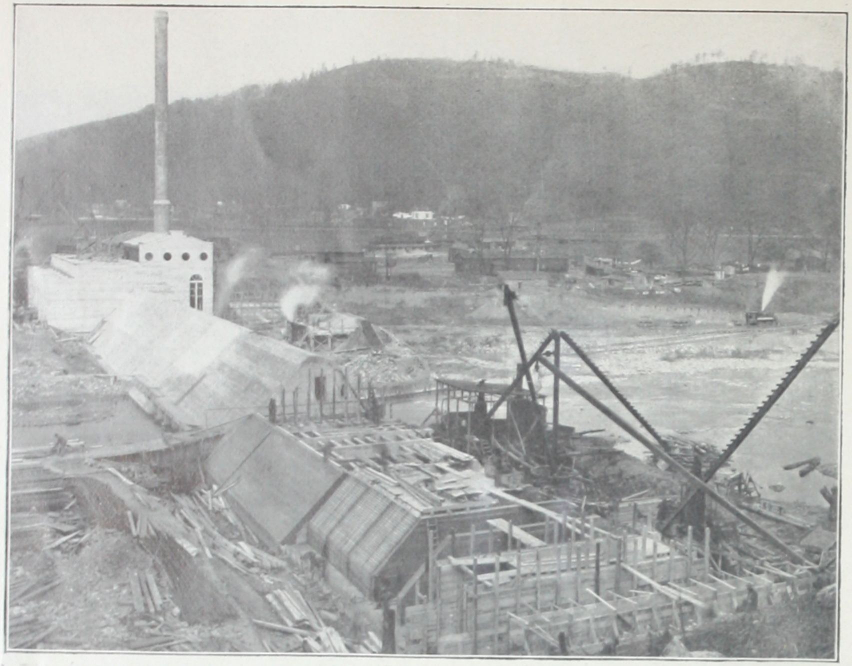
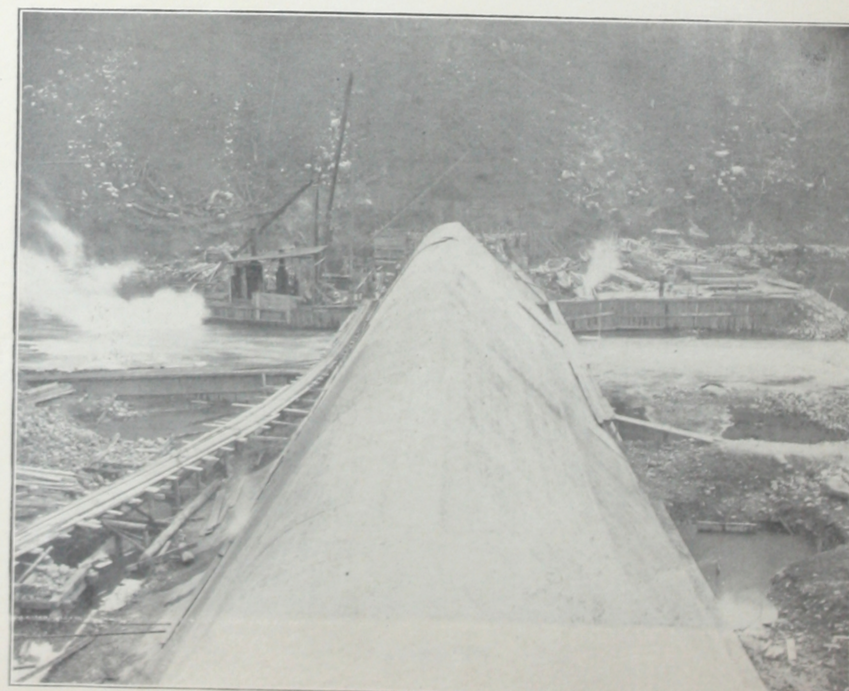


PLATE 15

PLATE 15. This cut which, like the others, is merely from a series of progress photographs, shows the dam in all stages of construction. In the foreground the buttress forms are set up and in the second section the steel is in place ready for laying the deck. In the next section a portion of the deck is in place. Beyond the coffer dam is shown a completed section of the dam with power house.

PLATE 16. This is a view of the completed half of the rollway looking outward from the power house. It gives an admirable idea of the obvious stability of the whole structure. We regret that we are obliged to go to press before we can show pictures of this dam under flood.



DANVILLE DAM

This is a very interesting case of raising a stone dam owned by the Danville Water Works at Danville, Ky. The stone dam was nearly new but had not in itself sufficient stability to stand under any flood, were it not for the heavy bank of quarry spawl and clay above it. It became necessary to raise the height of the dam 4 feet, which was carried out as shown. Openings are left below the apron to equalize the tail water, and an air inlet is provided by a 6-inch pipe carried out through the abutment and extended above high-water mark.

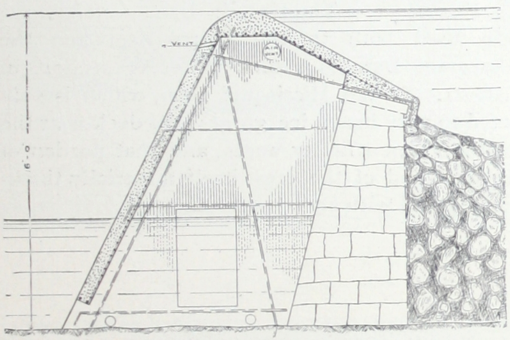


PLATE 17.

This river is subject to occasional floods up to ten feet on the crest and at such times the dam is practically submerged.

The photograph is a view of the down-stream face of the dam, which is 227 feet long over all and 16 feet high, the tail water standing about 5 feet deep at its base. Consulting Engineer William B. Fuller, 170 Broadway, N. Y.

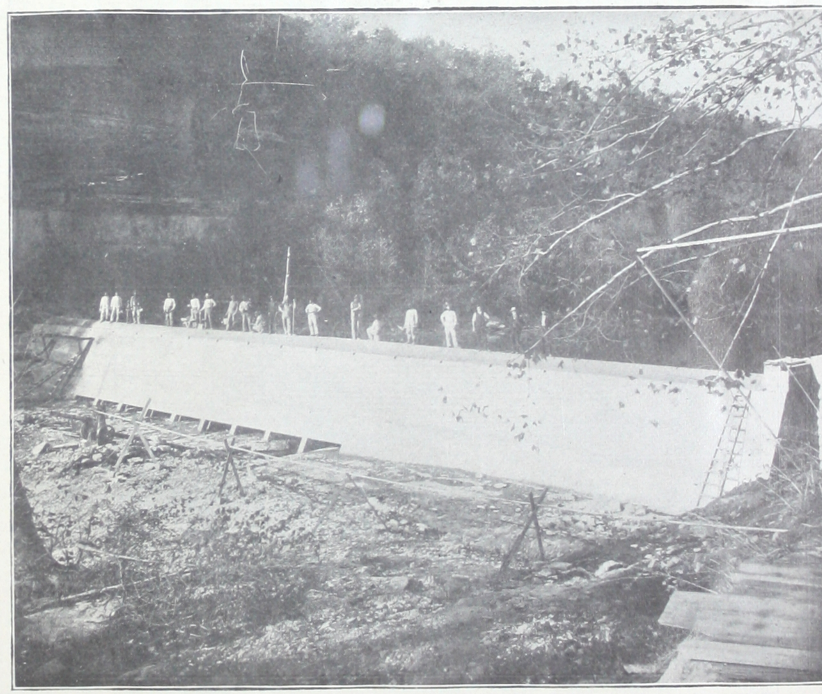


PLATE 18.

CAIRO DAM

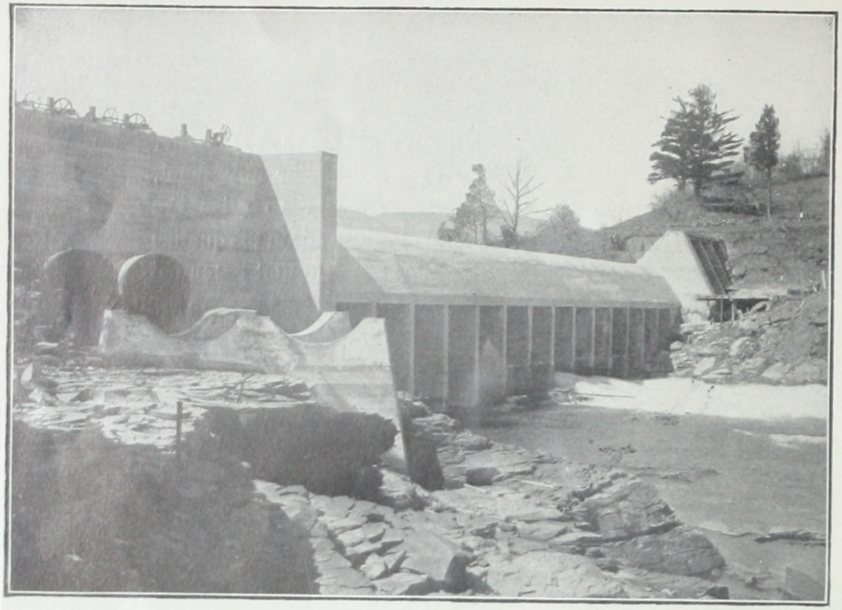


PLATE 19.

This is a dam 28 feet high and 200 feet long in the rollway, built for the Cairo Electric Light & Power Company, across the Catskill River about two miles from Cairo, New York. The Stevens-Hewitt Engineering Company, Park Row Building, New York, were the engineers for the company.

It is a Curtain Dam on a rock foundation, and is subject each year to an attack of heavy ice gorges. The power house is some 1200 feet below the dam and the water conveyed thereto by penstocks, the head joints of which are shown.

PLATE 20 is a view of the dam under flood.

PLATE 21.—The Curtain Dam, which is the form used both in the Cairo Dam and the Missisquoi Dam is shown in cross section in Plate 21. In the Missisquoi Dam, which is subjected to very heavy ice gorges, the deck near the crest is given a flatter angle, and that portion of the deck and of the crest itself materially thickened up and with added reinforcement.

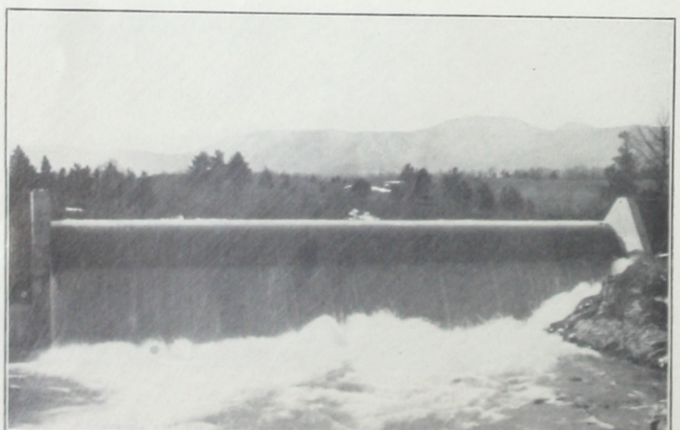


PLATE 20.

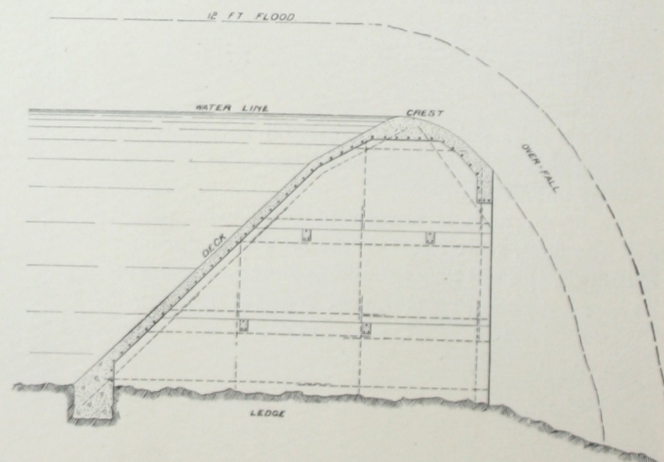


PLATE 21.

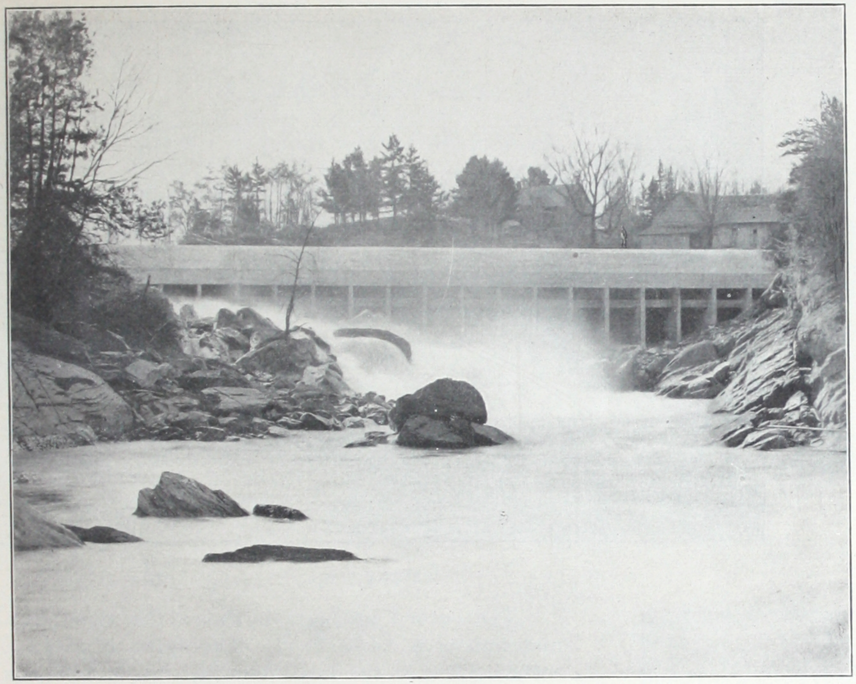


PLATE 22.

MISSISQUOI DAM

This is a Curtain Dam on rock foundations at the head of a sharp pitch in the river. The height in mid channel is 40 feet and the total length between the abutments is 270 feet.

Only 180 feet of this length shows in the picture, the remainder being concealed by the rocky point at the left. This picture is deceptive as an example of extreme fore-shortening. It is really 600 feet from the black rock in the center of the picture up to the dam, and one-eighth of a mile from the dam back to the house on the hill.

This dam is especially designed to withstand the heavy ice gorges which have carried out three dams at this point within ten years. It is calculated for a 12-foot flood and at the time of the photograph was under a flood of 5 feet 9 inches.

The supplementary views show the same dam in mid winter with the ice 20 feet thick below it.

PLATE 23.

PLATE 24.

PATAPSCO DAM

The first illustration might very well be entitled "Puzzle — find the power house." This dam is across the Patapsco River near Ilchester, Maryland. The rollway is 30 feet high and 200 feet long. The excessive floods on this river and the narrow gorge at that point necessitated utilizing the entire width of the river as a rollway, and considerations of expense prohibited the placing of the power house at some distance below the dam.

With some reluctance we were obliged to use the space underneath the rollway as a power house, which is laid out to contain three 500 H. P. units. The power house itself is enclosed with 4-inch walls of ferro-inclave, entirely separate from the structure of the dam itself. The power house is light and airy and there really is nothing to be apologized for with regard to it except that the space was too limited to give us all the convenience desired, and which would be obtained with a somewhat higher dam.

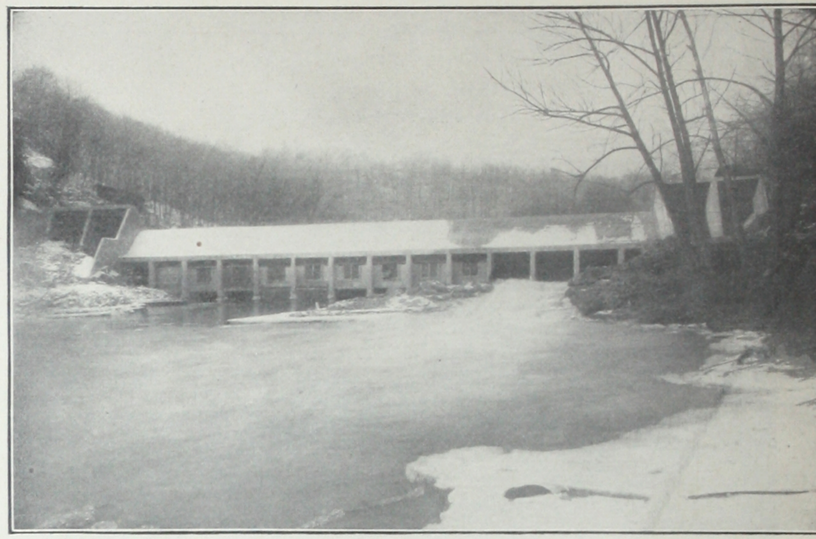


PLATE 25.

The second photograph shows the same dam under about a 2-foot flood. The apron is given a reverse curve on the lines described by us as in our circular as a half apron dam. The effect of this is to throw water far below the foot of the rollway as seen.

PLATE 26.

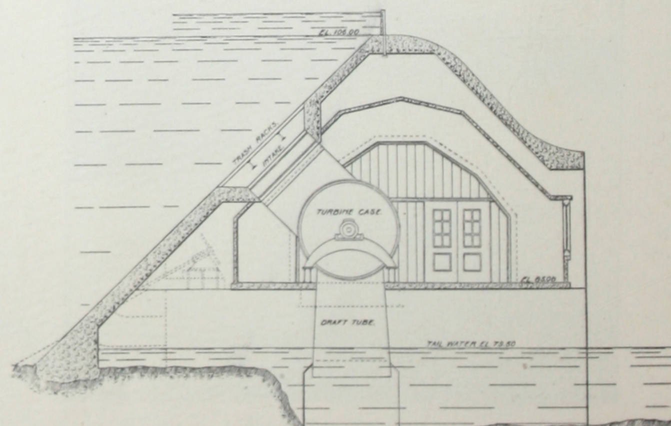


PLATE 27.

COLLIERS DAM

This dam is 32 feet high and 250 feet long on the rollway with a river wall of similar construction 300 feet long forming a forebay for the power house. It is a full apron dam built on a soft rock foundation but without floor. We exhibit two views, one of which is a general bird's eye view of the dam and river wall under construction, and the other a closer view showing the buttresses in place, the forms ready to receive the deck and the openings left for handling the water during construction.

This dam is across the Susquehanna River at Colliers, N. Y. It is built for the Stevens-Hewitt Engineering Co. Park Row Bldg. New York who were also the Engineers for the Cairo dam. We are obliged to go to press before this dam is completed.

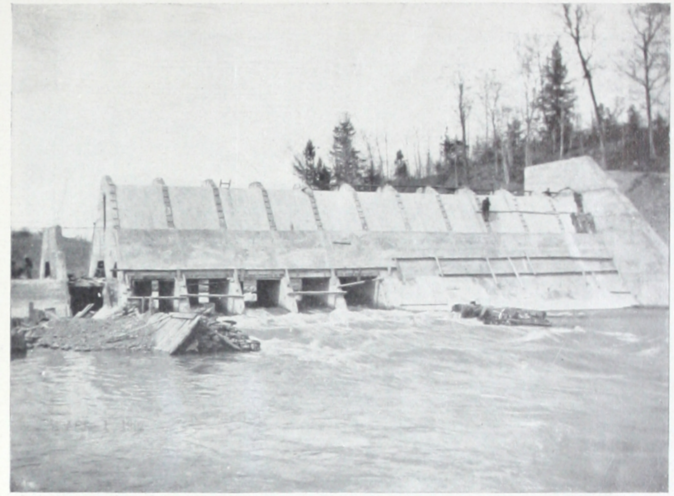


PLATE 28.

PLATE 29.

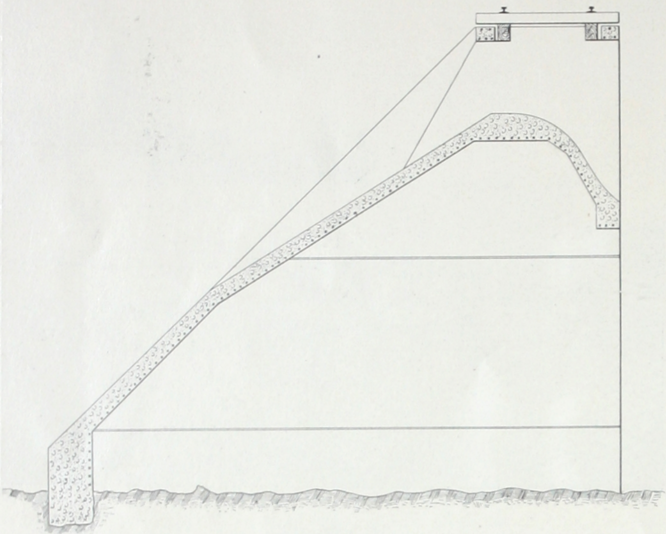


PLATE 30

HORSE SHOE DAM

This is a dam of special design built for A. A. Low, on the Bog River in the Adirondacks near the station of Horse Shoe, N. Y. The flow of the stream is limited and the rollway is therefore only 70 feet long and contains a log sluice. The height of the dam is 25 feet and the total length 250 feet, of which 180 feet is in bulkhead.

The special feature of this dam is that it also forms a bridge for a steam railroad.

PLATE 30 is a section of the dam through the rollway. The buttresses are carried up through the deck and braced by concrete-steel beams at the corners. Timber stringers span between the piers and carry the ties and rails.

PLATE 31 shows three bays of the rollway, the log sluice, and beyond that the fishway.

PLATE 32 is a general view of the dam and both photographs show the locomotive in position over the rollway.

PLATE 31

PLATE 32

GRAYS DAM

This dam is of peculiar interest as it was required to be built on a strict clay foundation without gravel, hardpan or ledge. A further stipulation was that the dam should be carried to a present height of 30 feet with provision for increasing the height to 40 feet, at the same time keeping the cost as near as possible in relative proportion to the height. The foundation was so soft as to show the print of a foot when the concrete floor was laid. The proportions were such that the distributed load due to the weight of a 40 foot dam and flood was 1.25 tons per square foot.

The means used for a future increase of height are shown in the sectional cut. The buttresses are carried up to the 30 foot grade and the front edge stepped off as shown, with corrugated rods left projecting from the edges. A temporary plank apron carries the water, logs and ice and protects the rods.

Later on when the dam is to be raised the apron is removed, buttress forms set up and the dam carried up to its full height. The added section is self-stable without the rods but of course the rods bond the whole structure into a single monolith the same as if originally so constructed.

PLATE 33

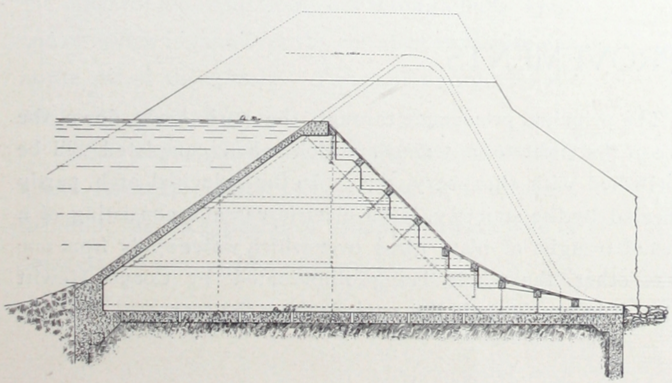


PLATE 34

PLATE 34 shows the 30 foot height and the plank apron. The whole job is eminently successful and opens up a new possibility both in respect of foundations and in respect to increasing the height of the dam.

The dotted lines show the full height of the 40 foot rollway and bulkhead when completed.

Four of the bays contain an admirable arrangement of weirs whereby the discharge of the reservoir can be accurately measured; the dam being built near Grays, N. Y. to create a water supply for the Consolidated Water Co. of Utica, N. Y.

PLATE 35.

DELLWOOD PARK IMPROVEMENTS

That concrete may lend itself to architectural treatment is fairly demonstrated by the structure here illustrated. The work was executed for the Chicago & Joliet Railway in their pleasure grounds known as Dellwood Park, about five miles from Joliet, Ill.

The principal structure is a combined dam, esplanade and grotto. The rollway of this dam is 18 feet high and 150 feet long between abutments.

The principal promenade through the park leads down the space at the right to a terrace, which when completed will be embellished with shrubbery, etc. In the principal arch, partly concealed by the stairway, is an electric cascade consisting of a series of troughs of plate glass over which water spills from one to the other, the whole being illuminated by Cooper-Hewitt Lights shining through the cascade from the rear.

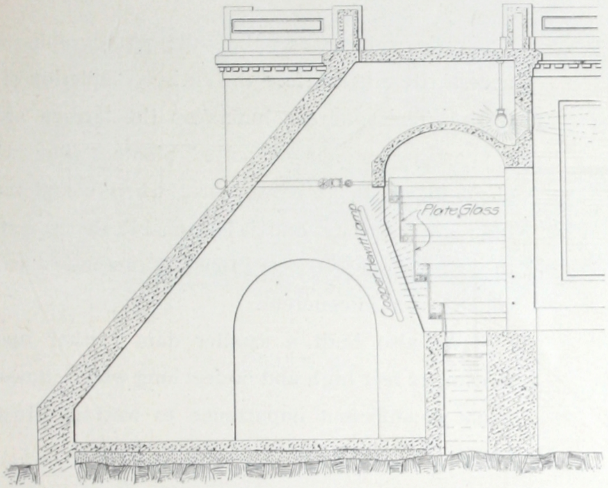


PLATE 36.

The smaller arch to the left gives entrance to a grotto underneath the dam. The arrangement of the cascade is shown in Plate 36, and of the grotto in Plate 37. Each 10-foot bay of the dam contains a mass of rock work carrying ferns, mosses and semi-aquatic plants, kept moist by a drip of water conveyed through perforated pipes. On the opposite side of the bay is a seat forming a delightful resting place in the heat of summer.

The whole grotto is brilliantly illuminated by incandescent lights in each bay. The exit from the grotto is at the other end of the dam and the whole arrangement is distinctly the feature of the park.

Electric arc lights shine out through bulls' eyes, one of which is seen over the entrance arch, also one at the end of the rollway. Terra cotta gargoyles are used with good effect.

The various panels are hammer dressed and the whole structure seems to have lost in a measure the dull, lifeless appearance usually characteristic of concrete.

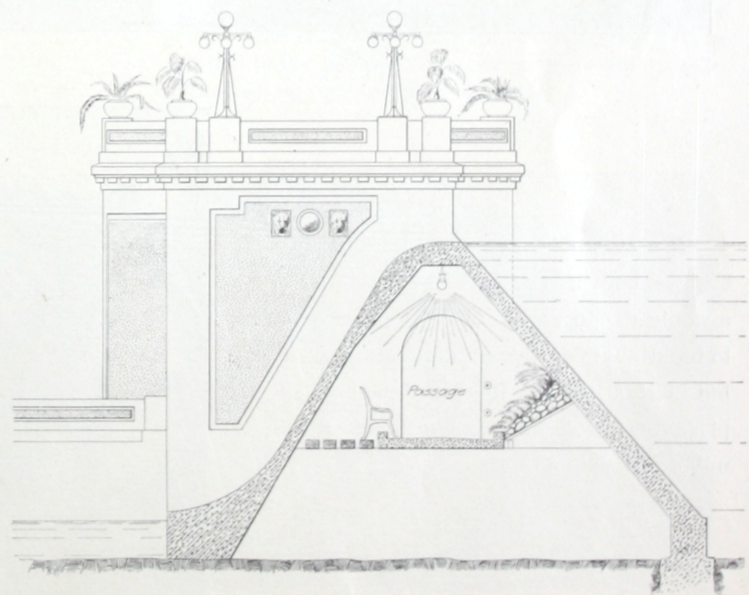


PLATE 37.

Plate 38.

It is unfortunate that the photographs were necessarily taken before the entire completion of the work. The square columns on the terrace are to support jardenieres of potted plants. The whole effect including the boathouse when completed is highly appropriate, and it is probable that the structure as a whole is one of the best examples of artistic construction in concrete.

We also built a smaller dam further up the stream, 12 feet high and 60 feet long which, however, is not of sufficient importance to warrant illustrating it.

We also built two very beautiful bridges, both illustrated herewith. As a whole we do not go out of our way to build anything but hydraulic work, but in this instance it seemed best to place the whole work in our hands for uniform execution.

Plate 39.

PLATE 40.

RUSSELL DAM

We illustrate a remarkable "dry test" on a 16-foot dam on the Westfield River, Mass. The dam was still unfinished and the water was carried off through several sluice gates. The river broke up in March, the ice coming down for twenty miles and stranding for half a mile above this dam. Shortly after the water rose until when about half way up the dam the head was sufficient to discharge the entire flow through the sluice gates. The effect, however, was to float the ice and to start a heavy "shove" by means of the "quick water" in the rapids half a mile up-stream. The ice encountered the dam but finding no water to float it, it was shoved bodily, hundreds of thousands of tons of it, over the *dry crest* of the dam, falling into the water below and going on down stream. The sectional drawing was made to illustrate this as near as it can be done. Under such conditions a solid dam with a vertical up-stream face would have inevitably gone out. The two photographs show the pond just above the dam before the "shove," and the rollway of the dam itself

PLATE 41.

about a week after the water had gone down and the ice had settled back. Not even a scratch was visible to indicate the rough treatment received. The same test, on the same day and with the same results was applied to the ~~Colliers~~ CAIRO Dam, but we were unfortunate in having no photographer at hand.

PLATE 42.

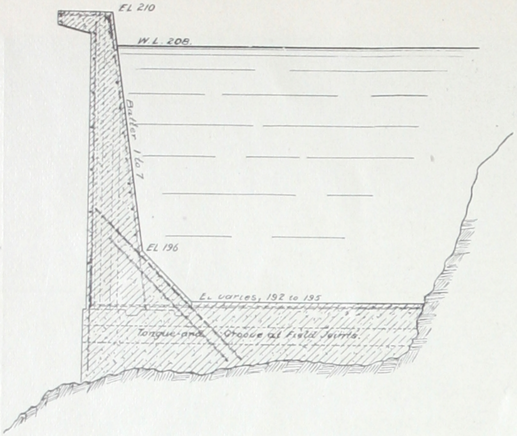


PLATE 43

PLATE 44

BULLS BRIDGE CANAL

This piece of work, while not a dam was, nevertheless, a hydraulic problem of great difficulty.

A section of the canal supplying the power house of the New Milford Power Co., New Milford, Conn., washed out last November. Under the direction of Mr. John Birkinbine, of Philadelphia, engineer, a large wooden flume was built as a temporary relief. A view of this flume is shown in Plate 44. Its great weight was carried on a multitude of posts resting on the rock.

Having secured partial service by this means the next problem was to build a permanent structure of reinforced concrete around this flume without interrupting the service. The difficulty of the job was vastly increased by the necessity of carrying it on in the dead of a severe winter, hampered by leaking water, tons of ice and continuous low temperatures.

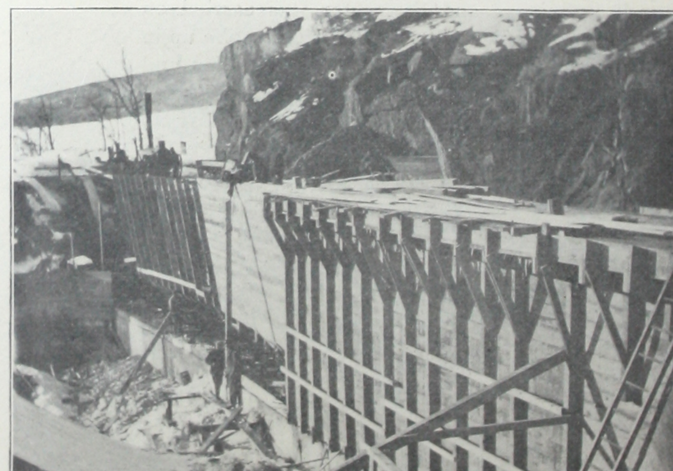


PLATE 45

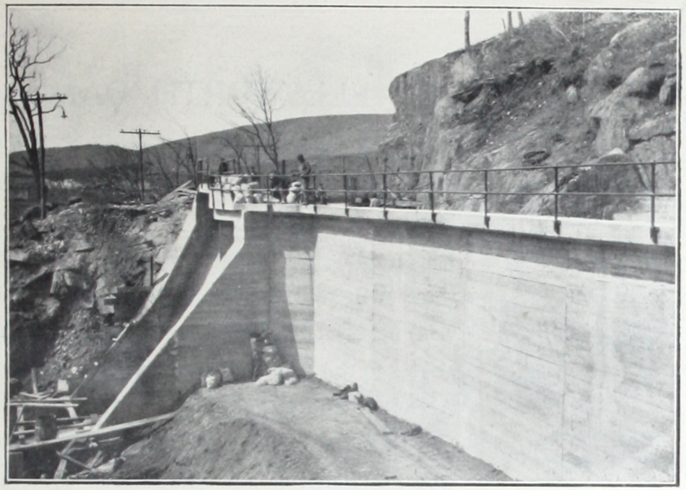


PLATE 46

PLATE 43 is a section of the temporary and permanent work showing that the concrete flume was designed as a cantilever. Work was carried on by housing in sections, protecting them from leakage by a false roof and warming by salamanders.

PLATE 45 shows part of the bottom and the forms for the wall in place with the cantilever reinforcement appearing.

PLATE 46 is a portion of the completed structure with the waste gate between the two buttresses.

Up to this stage the work has been carried on around the temporary structure so that it now presents the appearance shown in Plate 47. It will be noted that the concrete flume is prolonged into a wall joining the flume by a warped surface.

The work being completed the various posts were sawed off under water as close as possible to the bottom of the canal. The entire flume was then floated in a single piece and towed out into the canal, as shown in Plate 48, and then broken up. Work was commenced in December and finished in April, at a cost considerably less than the original estimate. The difficulties presented in its execution were far greater than those usually accompanying the construction of an ordinary dam.

PLATE 47

PLATE 48

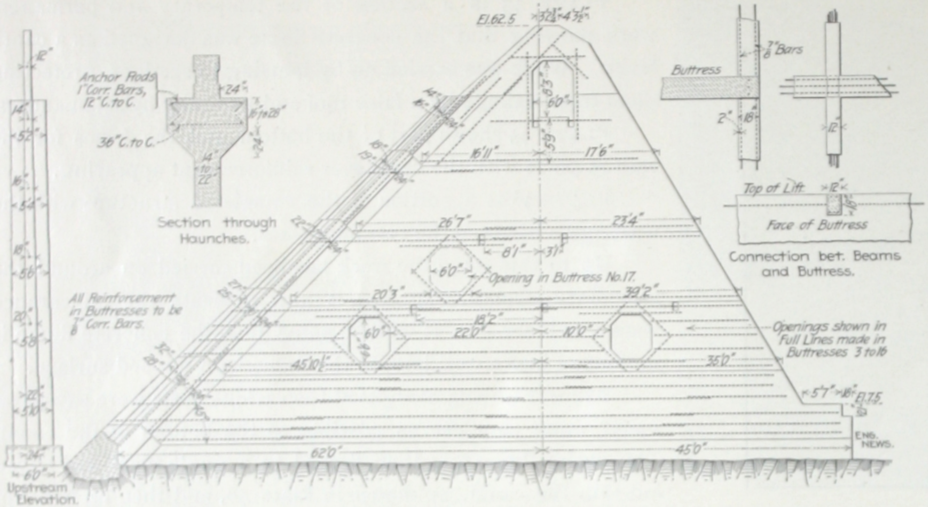


PLATE 49

ELLSWORTH DAM

We print some line drawings of the dam now being constructed by us at Ellsworth, Maine. The rollway is 64 feet high and the whole dam about 450 feet long. Conditions were such that the semi-detached power house was necessarily placed substantially at right angles to the dam and supplied from a forebay. Access to the power house and waste gates is had through the body of the dam by a passage way entered from the village side by a tower containing a spiral staircase, and on the other side directly from the power house. The space in the bulkhead is utilized as a machine shop, store room, toilet room, etc., etc. A sluice gate in the crest is provided to flush away the accumulated trash that may lodge against the bulkhead.

This dam is for the Bar Harbor & Union River Power Co. of Ellsworth, Maine and the engineers are Messrs. Sellers & Rippey of Philadelphia. It is the highest dam in New England.

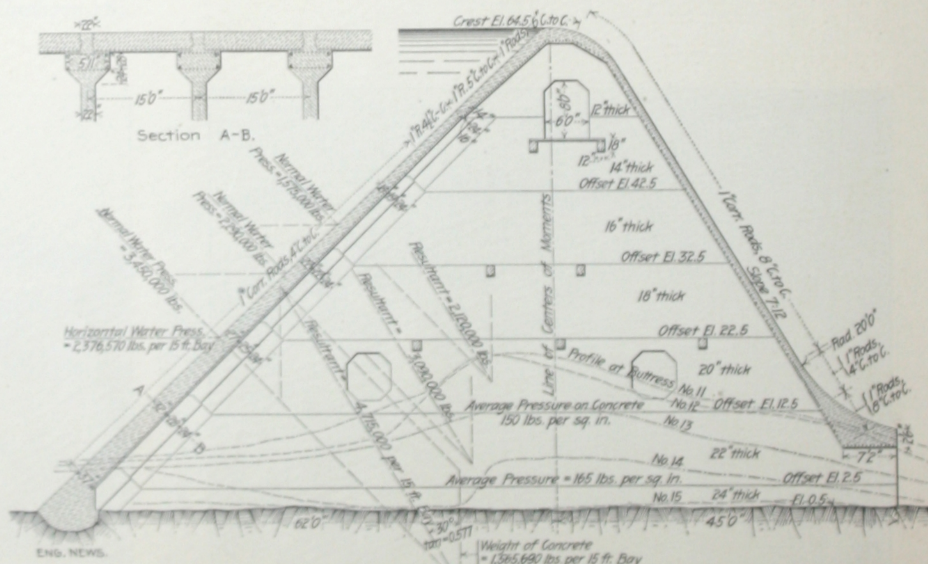
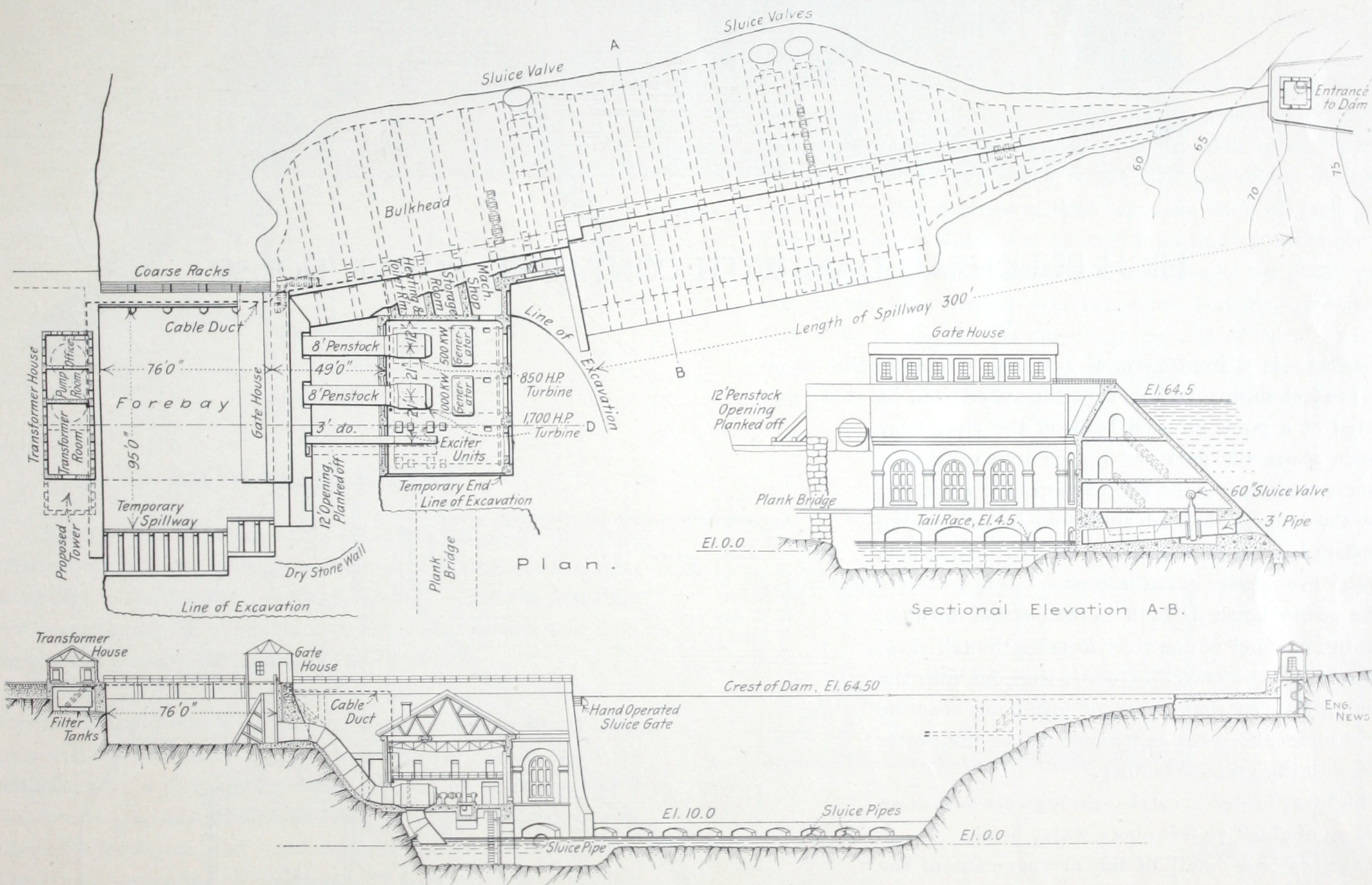


PLATE 50



Sectional Elevation C-D.

PLATE 51

BAR HARBOR & UNION RIVER POWER CO.

ELLSWORTH, ME.

SELLERS & RIPPEY,
CONSULTING ENGINEERS,
PHILADELPHIA, PA.

J. A. LEONARD,
CHIEF ENGINEER,
ELLSWORTH, ME.

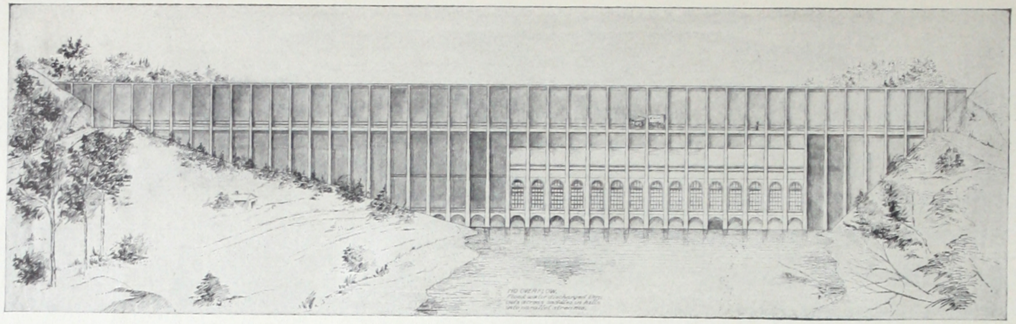


PLATE 52

HIGH BULKHEAD DAM WITH CONTAINED POWER HOUSE

PLATE 52 is a front view of a typical bulkhead dam 120 feet high. In this case the water is to be diverted at a point on each bank of the river some distance above the dam and turned into subsidiary channels returning to the main river about 1,000 feet below the dam. This is advantageous in maintaining a constant level of the tail race. In this type of dam no water ever passes over the crest.

The power house is built in the body of the dam, the entire channel of the river forming the tail race. The track for the travelling crane runs out into the adjoining bay so that a car of machinery can be backed under the crane and handled into the power house with the greatest facility.

A highway bridge is carried through the dam at an elevation of about 70 feet above water level.

PLATE 53 is a detail of the arrangement of the power house showing the stop logs, trash racks, head gate, forebay and penstocks together with a section of the power house and of the highway bridge. The whole arrangement is ideal in its directness convenience, simplicity and low cost.

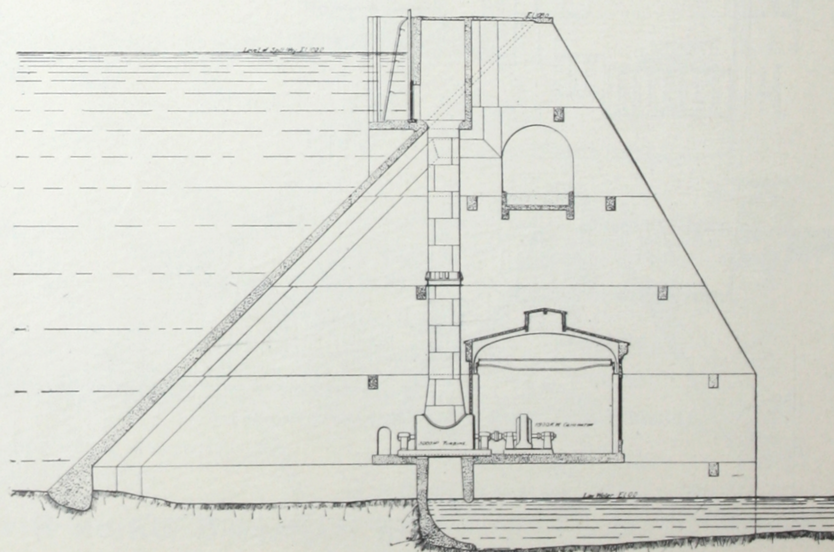


PLATE 53

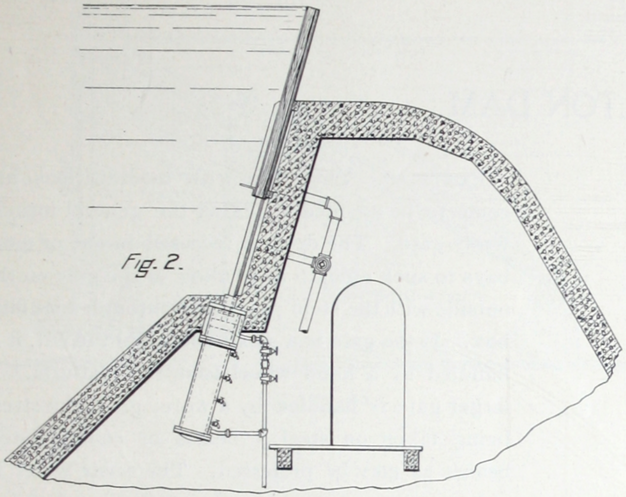


PLATE 54

MOVABLE CREST

The problem of a moveable crest has called for the best effort on the part of engineers without ever having reached anything like a satisfactory practical solution. For the first time and by virtue of the available interior of a concrete-steel dam we present a complete solution of the problem.

PLATE 54 is a section of a rollway and Plate 55 a series of inverted gates interlocking with each other forming the movable crest. Each section is handled hydraulically, or in small installations by a screw gear. The sections are composed of a steel frame, well braced and carrying needles of wood on which allowance for shrink and swell is made by the use of splines. The joint between the sections is made water-tight by a smaller needle bolted to one of the sections and playing in the angle iron of the other, all as shown in Fgure 3. An "I" beam is built into the concrete and the channel bars, forming the gate frames lock around it loosely as a guide. Pump pressure is transmitted by a main running through underneath the dam where it is entirely protected from freezing. Admission of the water above or below the leather packed piston actuates the gate, and the extent of its traverse is controlled by the petcocks on the cylinder. It follows, therefore, that the Movable Crest may be operated either by the complete lowering of any one or more sections, or by lowering simultaneously all the sections to a nicely graduated degree.

A very important feature is the method of clamping the gates in position. This is effected by opening the three-way cock so as to exhaust the water from the thin space between the gate and the dam which is bounded by timbers built into the dam forming a series of thin cells, one back of each gate. The moment the water is exhausted from this space the section is clamped in whatever position it occupies by the static pressure of the water acting over the entire surface. When the gate is to be moved the three-way cock is reversed and the space filled by the by-pass, thus balancing the pressure. The whole device is cheap, simple and in every way practical.

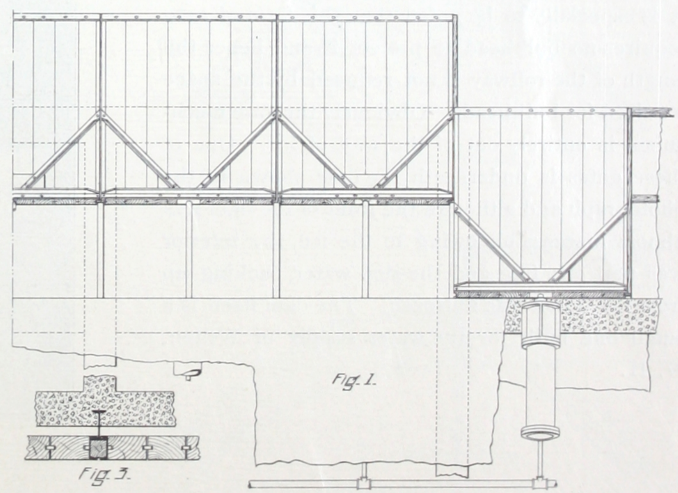


PLATE 55

WASTE GATE IN WILTON DAM

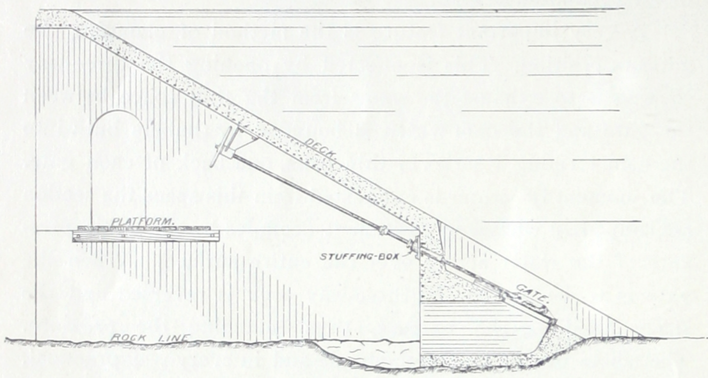


PLATE 56.

PLATE 56. This form with modifications has come to be adopted by us as the general form of waste-gate. The deck is recessed in one or more bays to such a depth as to allow of the gate on the outside with the stem passing in through a stuffing box. If the gate is a small one, as in the cut, it is handled by a hand wheel from the platform. A larger gate is handled by a worm gear, the stress being taken on steel I beams or concrete-steel beams as may be preferred. The waste water in either case passes out underneath the platform.

It is especially to be noted that this form of gate requires no bulkhead to protect it and hence the length of the rollway is not reduced by the space required for bulkheads. Obviously the gate mechanism is entirely out of the way of ice. One of these gates is underneath the dam shown in the photograph and although the front of the dam was almost inaccessible owing to the ice, the interior was perfectly free and the slop water backing up from the brook was unfrozen. The dam itself is a small one built for the water supply of Wilton, N. H.

PLATE 57.

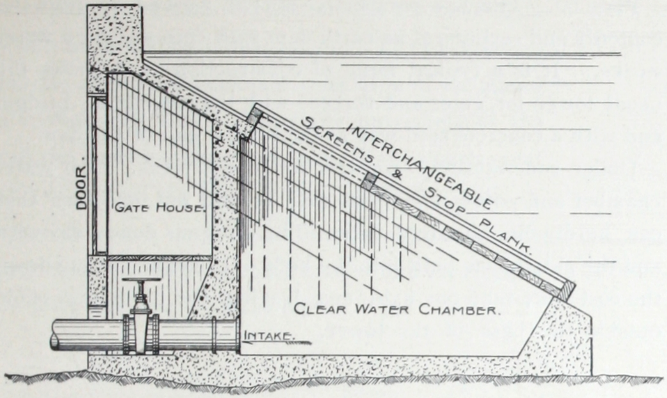


PLATE 58.

SCREEN CHAMBER, GATE HOUSE ETC.

On small reservoir dams as at Wilton, we frequently take advantage of one or more of the bays to do away entirely with the usual expensive construction for gate well and screen chamber. A reinforced vertical partition between the buttresses creates a clear water chamber under the deck. Water is admitted through interchangeable screens and stop planks. The relative positions of each may be changed each season of the year as required, thus enabling water to be drawn either from the top or bottom of the reservoir. The front portion of the bay is enclosed and forms a convenient gate house.

FLASH BOARDS

PLATE 59.—The hollow space in the dam enables us to use a very satisfactory form of flashboard. Instead of a wooden stanchion to break off, or a light iron rod to bend over, we set a pipe sleeve in the concrete through which a stiff steel rod loosely passes. The flashboards in position are shown at the top, and when desired to release, the rod is turned half way around and pulled down until the hook rests in the socket formed in the crest. The flashboards then drift away and are recovered, while the rod is out of the way of ice and logs, and can be raised into position the following year,—all as shown in the lower cut. If the dam is also used as a bridge the drip from the sleeve is protected by a lightly packed stuffing box.

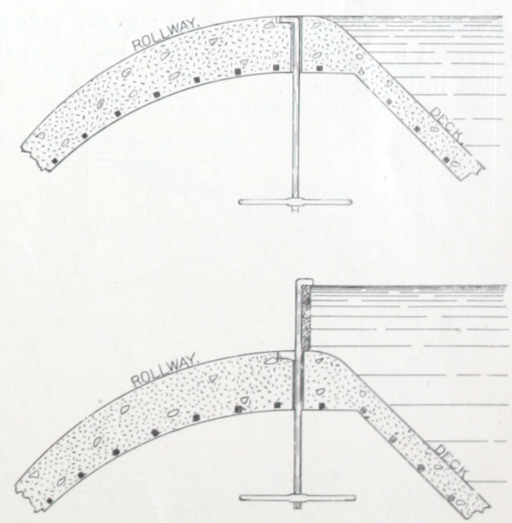


PLATE 59.

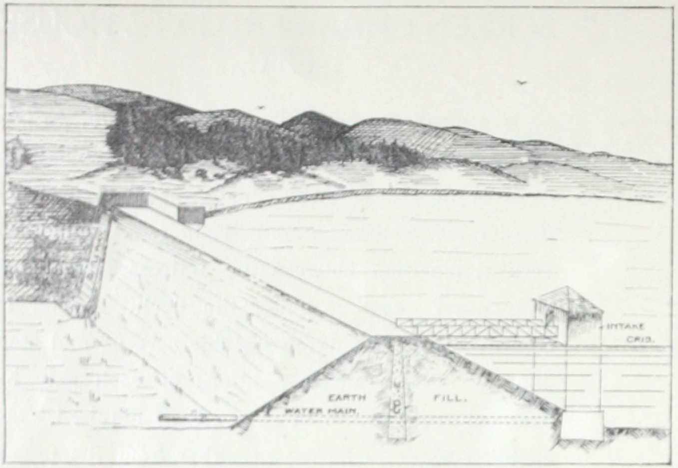


PLATE 60

The spill-way is especially unique and effective, as illustrated on enlarged scale in Plate 62. The flow of the stream being very small, even in flood, the spill-way is confined to three bays, aggregating 30 feet in a total length of 200 feet. A baffler of reinforced concrete is built between the buttresses and the space between the lip of the dam and the edge of the baffler is screened by a grid of 3/8 x 3 inch steel on 12 inch centers, bedded in the concrete.

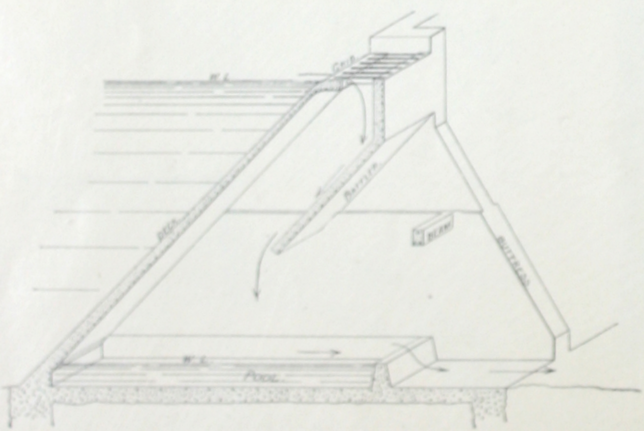


PLATE 62

Plate 60. This is a perspective sketch, worked up from the contours and sections of an earth dam with core wall for a water works. It is a typical form of construction, and shows the usual tower for gates and screens with the connecting bridge, and with a concrete spill-way at the further end of the dam.

Under concrete-steel construction the screens, clear-water chamber and gate-house, Plate 61, are laid out on lines that can hardly be improved upon. The bridge is done away with and the gate-house built into the body of the dam, cutting down the cost more than one-half, and leaving the pipes accessible outside the base of the tower.

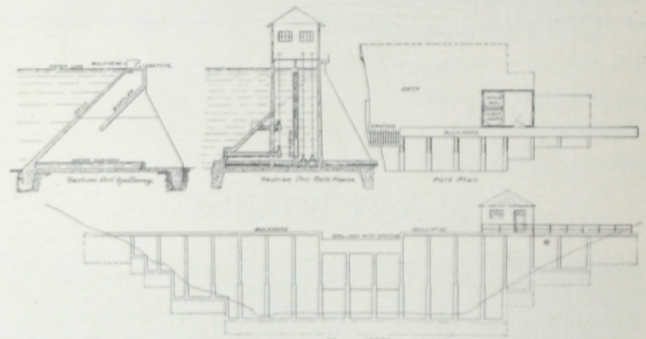


PLATE 61

The over-fall drops down on to the baffler and is deflected into a cushion pool, formed on the floor of the dam by a ledge of concrete. The final discharge is therefore carried out horizontally, without the possibility of scouring the river bed, which in this case is of clay and gravel. The whole design, though novel, will stand study and criticism.

On this particular stream there is no danger of any flood ever over-leaping the grids. Assuming, however, that this design was used in some other location, involving the possibility of extreme floods, it will be seen that by the time the spill was great enough to jump the grids, the excess would be received on a volume of horizontal discharge out of the base of the dam, which would effectually cushion its free fall. This design, however, is primarily intended for the spill-way on a Water Works dam where the stream flow is light.

Plate 63 — This is a section of a reservoir dam to be built in a river of magnitude. The dam has no spillway as the main channel runs around an island in another direction. Under the provisions of the deed the owners are required to maintain a permanent bridgeway from the mainland to the island. This we incorporate as a part of the dam construction, the wash from the roadway being turned into the river on the down-stream side of the dam.

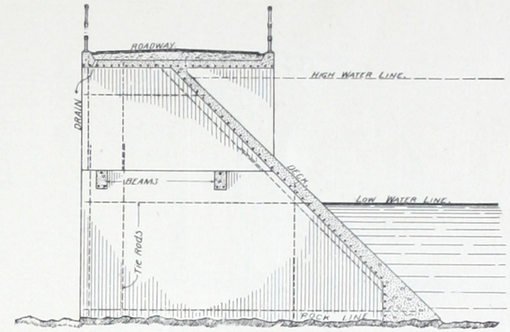


Plate 63

Plate 64 — is a special and novel design for a low dam in connection with a lake forming part of a Park System. No Buttresses are used, but the dam itself is a continuous tube. The down-stream apron is reinforced in both directions against flexure due to compression, and serves the double purpose of an apron and of a strut to support the upper edge of the deck. The latter is reinforced on the lower face only, but it will be noted that as it is an inclined slab, supported at the upper and lower edges, the reinforcement runs up and down, instead of horizontally, as in our other dams having buttresses. This type of dam is limited in its height, but is exceedingly satisfactory for a low dam requiring an apron.

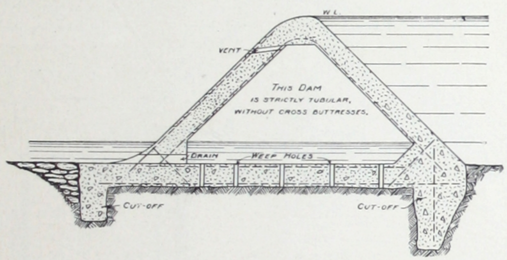


Plate 64

Plate 65. — This is a preliminary design for a dam 67 feet high in a sharp gorge.

Note the supporting arch across the cleft of the gorge, forming a foundation and permitting of easy handling of the water during construction.

Note the convenient location of the waste gate.

The rock is hard and the pitch of the bed rapid so that only a half apron is required, and the face and foot of the dam will be free from ice in the winter season.

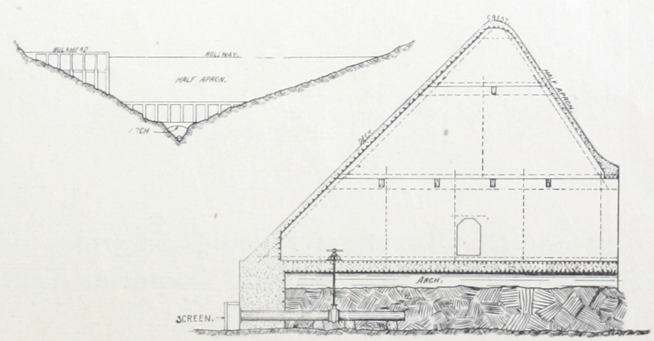


Plate 65

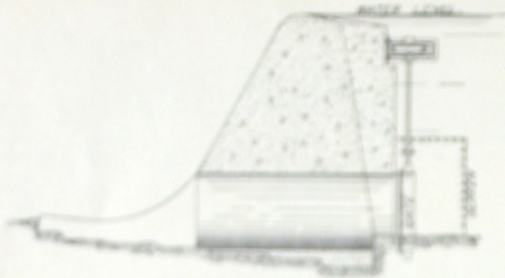


Plate 66

Plate 66. This illustrates the application of a wicket gate to a proposed dam in Pennsylvania. The original design, as shown at the top, was for a solid dam with a 7-foot steel tube carrying a wicket gate at the up-stream end,— the gate to be operated by a worm gear and power shaft underneath the water. The objection follows that if by any accident the worm gear is disabled it can neither be reached nor the pond drawn down.

The lower design, submitted by us, very naturally brings the wicket gate inside the dam, where it is at all times accessible for operation or oiling and for repairs. No power shaft is required as a 7-foot gate can be operated by a hand wheel. The worm gear can be liberally oiled, thereby reducing its friction. The discharge outlet is made of concrete-steel, instead of a steel tube and the entire device becomes very much more satisfactory from a mechanical standpoint, as well as maintaining the full length of the rollway.

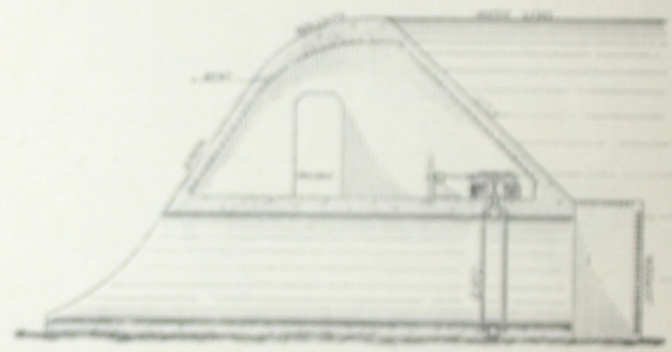


Plate 67

In addition to the foregoing examples we have built a large number of other dams, which however do not present features essentially differing from those illustrated. On account of space limitations they are omitted.